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SOME PROBLEMS AND METHODS IN DUBLIN BAY PRAWN (Nephrops norvegicus) RESEARCH.

by

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INTRODUCTION.

Much is in the process of being learned about the Dublin Bay Prawn or Norway Lobster Nephrops norvegicus (referred to simply as the 'prawn' hereafter) but compared with many other commercially fished species much still remains a mystery. This paper describes methods of examination of its biology and ecology designed to yield information on habits, movements and especially growth and death-rates, these being the two most important factors in the prosperity of the fishery.

There are two main problems posed by the prawn. The first is that, like all crustaceans, it has no known structure in its body bearing a record of its age which makes impossible direct determinations of age based on yearly growth-rings of scales or otoliths (bones in the ear) used for most commercial species of fish. The second problem is the great variability in the size of the catch on any one fishing ground, which makes sampling for comparison of different areas difficult. This is because this prawn is a burrowing species and thus many may appear to vanish from an area within minutes by simply retreating below the sea-bed.

The factors best known to cause disappearance from the catch are presence of too strong or too weak illumination, too strong a current on the sea-bed, strong winds (especially if onshore) and possession of external eggs - after the first few weeks - in breeding females. Of these factors, the degree of illumination and possession of external eggs appear to reduce the catch by causing prawns to retreat into their burrows whilst the reduction of the catch due to strong currents may be caused either by prawns retreating into their burrows or by reduced effectiveness of the fishing gear. In addition to the above, random or seasonal movements appear to take place as the location of large concentrations of prawns can change markedly and swiftly.

In this paper, the findings of the following surveys are discussed:-

(i) Distributional trawl surveys in September 1969 and February 1970.

(ii) Sets of successive hauls in the same area to compare the effect of differential illumination during dawn or dusk, October - December 1969.

(iii) Larval plankton net surveys in May and June 1970.

The paper also indicates methods of growth assessment based on analysis of trawl samples and on moulting records in captive post-larvae.

DISTRIBUTION

Seasonal variation

The findings of two trawl surveys, in September 1969 and in February 1970, are given in Figs. 1 and 2. These surveys consisted of a series of hauls of half an hour standard length with a 20 fathom prawn trawl of 40 mm cod-end mesh, passing through the centre of each square on the maps, Figs. 1 and 2. Fig. 1 shows the distribution of males, a striking disappearance of which took place between September and February in the easternmost areas south of latitude 53° 45' N, with a reduction in the shallow areas at the extreme north-west of the grounds, partially offset by increases in the shallower part of the area slightly further south-east. The female distribution (not shown) was similar to that of the males in September, but nearly all adult females had disappeared by February. Fig.2 shows comparable changes in distribution in juvenile prawns of both sexes, with carapace lengths of under 18 mm in September and under 20 mm in February. In this case the decrease in numbers in the south-east and the increase in the north-west suggests strongly that seasonal movement was taking place.

Variation with the hour of day.

This is a well known and spectacular type of variation in the number of prawns available for catching. Simpson (1965) and Hillis (1971) have already investigated it in the Irish Sea, but the experiments described in this paper have consisted of short closely spaced hauls to give greater detail than previous surveys. Parallel hauls were made in November, 1969 very close to each other (0.25 lanes apart on 'Decca' navigation aids) covering the hours of transition between darkness and light. The changes in catch over sunrise and sunset are shown in Figure 3. Data derived from these are given in Table 1 and those for the dawn show a steadily increasing lateness of the peak hour with increase in depth, with an increasing catch in broad daylight (three hours after sunrise) as depths increase beyond 20 fathoms. Unfortunately, results for the dusk are much less clear, partly due to bad weather during the experiments. The results for 14-16 fathoms, obtained six weeks earlier than the others, are particularly atypical. One feature, however, which is apparent from a comparison of dawn and dusk results in a slight time lag, the amount of light at the time of the peak catch at dusk being slightly less than that at the time of the peak catch at dawn in

both 12 and 21 fathoms.

LARVAL DISTRIBUTION

While the distribution of planktonic larvae has been surveyed before in the Irish Sea (O'Riordan 1964, Hillis 1968) no attempt to follow their changes of distribution during the season had been made prior to 1969. Also, whilst planktonic larvae are relatively easy to survey, adult females with ripe eggs and early post-larval prawns are rarely caught, which greatly increases the value of larval studies.

After small-scale experiments in 1969, two surveys were carried out in each month from April to June, 1970. Hauls were made simultaneously with similar plankton nets (with intake diameter 35 mm) at intervals of 5 fathoms depth, and the larvae classified according to their characteristic growth stages (each of which lasts somewhat over a week). The distribution of these in the area surveyed during May and June, 1970 (very few larvae being caught in April) is shown in Figs. 4 and 5.

The increasingly south-eastern aspect of distribution, with increased larval age (and thus stage) at any one time is obvious in all surveys showing more than one stage. Movement south-eastwards with time appears less uniform, however, which may be due to hatching of larvae in successive 'waves' with intervals of little hatching activity. Another factor of some importance is the occurrence of relatively strong tidal currents in the south-eastern part of the area.

GROWTH STUDIES

Indirect methods.

A biologically basic and well known means of illustrating a sample of any fish or crustacean species is the length frequency curve. One taken from the September 1969 survey is shown in Fig. 6 for males and females and shows strongly marked 'peaks' (lengths at which prawns are numerous) and 'valleys' (where prawns are few). The interpretation of age from these curves by Petersen's method is on the basis that a peak represents the average length for an age group and a valley a length too high for one age and too low for the next.

This method is generally useful for young age groups only,

before there is much overlap of different age groups at the same length, but it is used here since, as has already been mentioned, prawns cannot be aged individually. In Fig. 6, well marked peaks for both sexes appear at carapace lengths of 16 and 22 mm approximately while, for males, there are two further peaks at 25 - 26 and 28 - 29 mm, which, however, may well represent a single rather variable age-group, probably group 3. The peaks centred on 16 and 22 mm may be taken as almost certainly representing average lengths for two age-groups, probably 1 and 2.

Direct methods.

By maintaining larvae in captivity the earliest bottom dwelling stages of adult appearance can be obtained. These are known as post-larvae and resemble adults except for lacking the sexually modified pleopods. As has been mentioned they are seldom caught and little is known of their growth rate (Figueirdo & Thomas, 1967).

In 1969 and 1970 some post-larvae were obtained and the progress of those that survived to moult is shown in Table 2, which indicates the percentage increase in length with each moult and interval between moults. Such growth rates will give maximum lengths of carapace about 7 mm by September and 16 mm (as shown in Fig.6) probably a year later, bearing in mind that the growth rate will be rather slowed down (a) by winter and (b) with increasing age. This confirms the hypothesis that the peaks around 16 mm in Fig.6 are indeed composed of prawns of Group 1.

SUMMARY

1. Problems in Nephrops research and methods of overcoming them together with distribution surveys indicating movement in adults and larvae are discussed.

2. The problems are (a) lack of means for ageing individuals and (b) a number of factors strongly influencing the size of catches on any given area of prawn grounds.

(3) Trawl surveys showed considerable differences between distribution patterns in September, 1969 and February, 1970 for males and for juveniles; adult females were absent from the February catch.

(4) The effect of the time of day on the catch was examined. Dawn and dusk peaks move towards hours of daylight with increasing depth.

(5) Plankton surveys showed a tendency for advanced larvae to occur further south-east over the prawn grounds than young larvae.

(6) The use of Petersen's method for ageing Nephrops is illustrated, and its limitations discussed.

(7) Findings of small scale laboratory growth surveys of captive post-larvae are discussed and a carapace length of about 6 - 7 mm for the September after hatching is deduced.

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ble 1. Influence on Nephrops catch of dawn and dusk.

Dawn

epth (fm)	Date	Interval between time of peak catch and sunrise (minutes)	Percentage of peak catch 3 hours from sunrise	
			before	after
1 - 14	20 Nov.	-40	0?	0
6 - 18	19 Nov.	-35	0?	0
22	21 Nov.	+ 5	0	12
9 - 32	13 Nov.	+25	0?	45
4 - 48	18 Nov.	+>120	?	?

Dusk

epth (fm)	Date	Interval between time of peak catch and sunset (minutes)	Percentage of peak catch 3 hours from sunset	
			before	after
0 - 12	26 Nov.	+75	0	10
4 - 17	14 Oct.	-60	80	10
1 - 22	27 Nov.	+20	0	0
1 - 32	1 Dec.	->60	?	0

Table 2. Mean carapace length (mm) and storage duration in captive post larvae. (Numbers of apecimens making up means in brackets).

Post-larval stage	Duration (days)		Carapace length (mm)	
	1969	1970	1969	1970
1	15.7(3)	18.8(6)	3.7(5)	3.6(7)
2	18 (1)	21.5(2)	4.5(2)	4.4(2)
3	-	18 (1)	-	5.2(1)

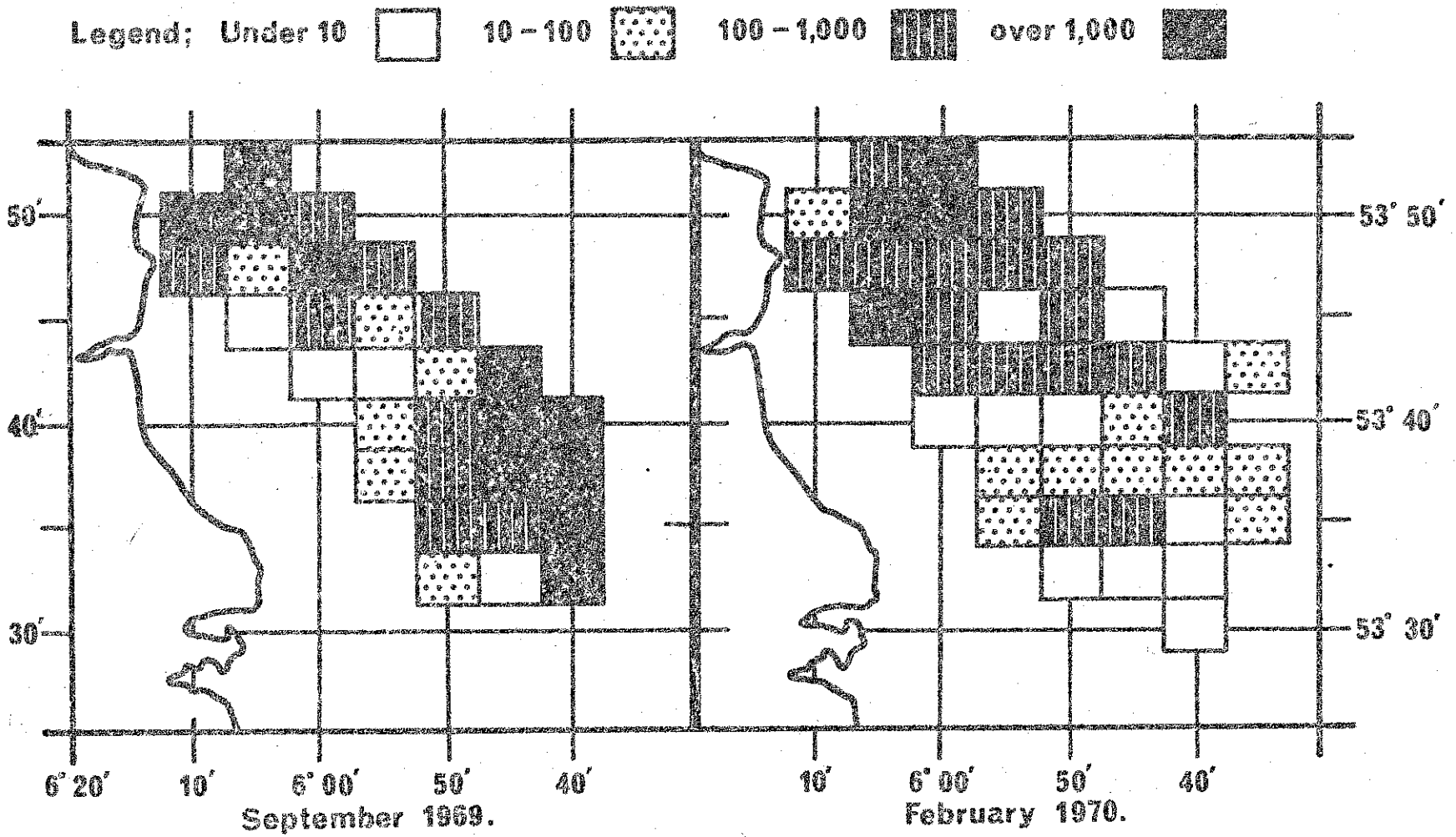


Fig.1. Number of males in trawl catch per 30 minute haul.

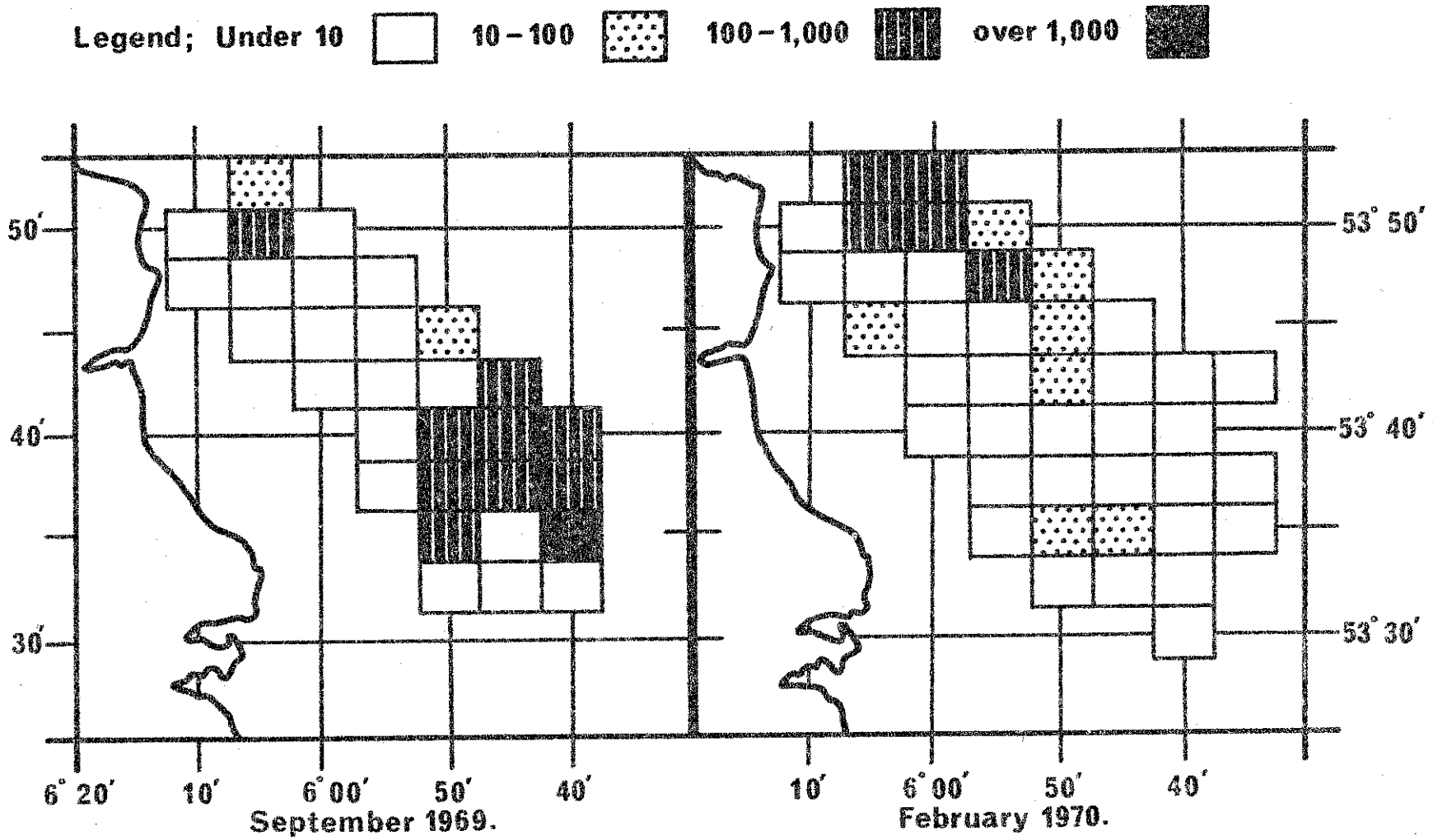


Fig.2. Numbers of immature prawns (up to 18 mm carapace length) in trawl catch per 30 minute haul.

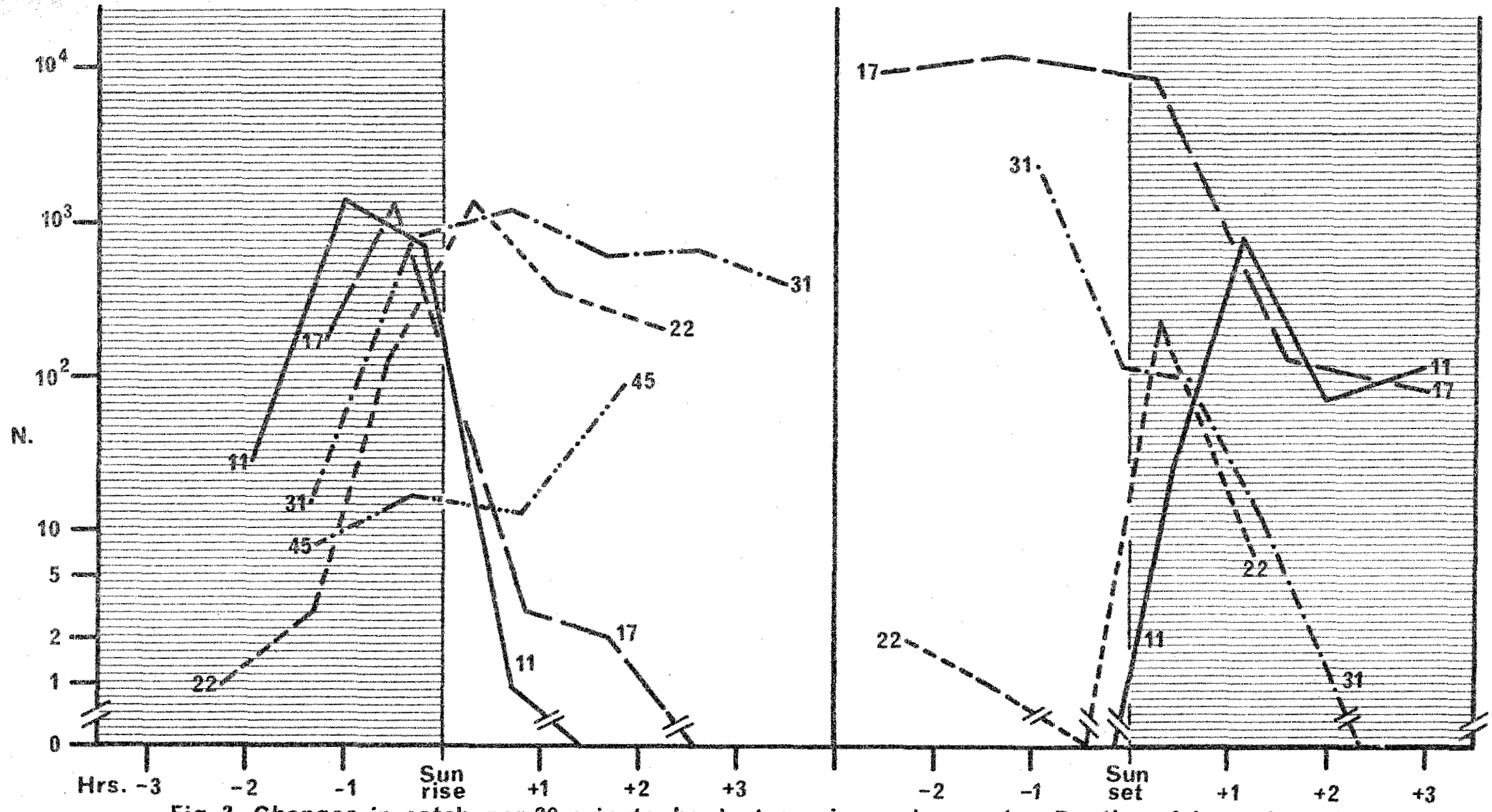
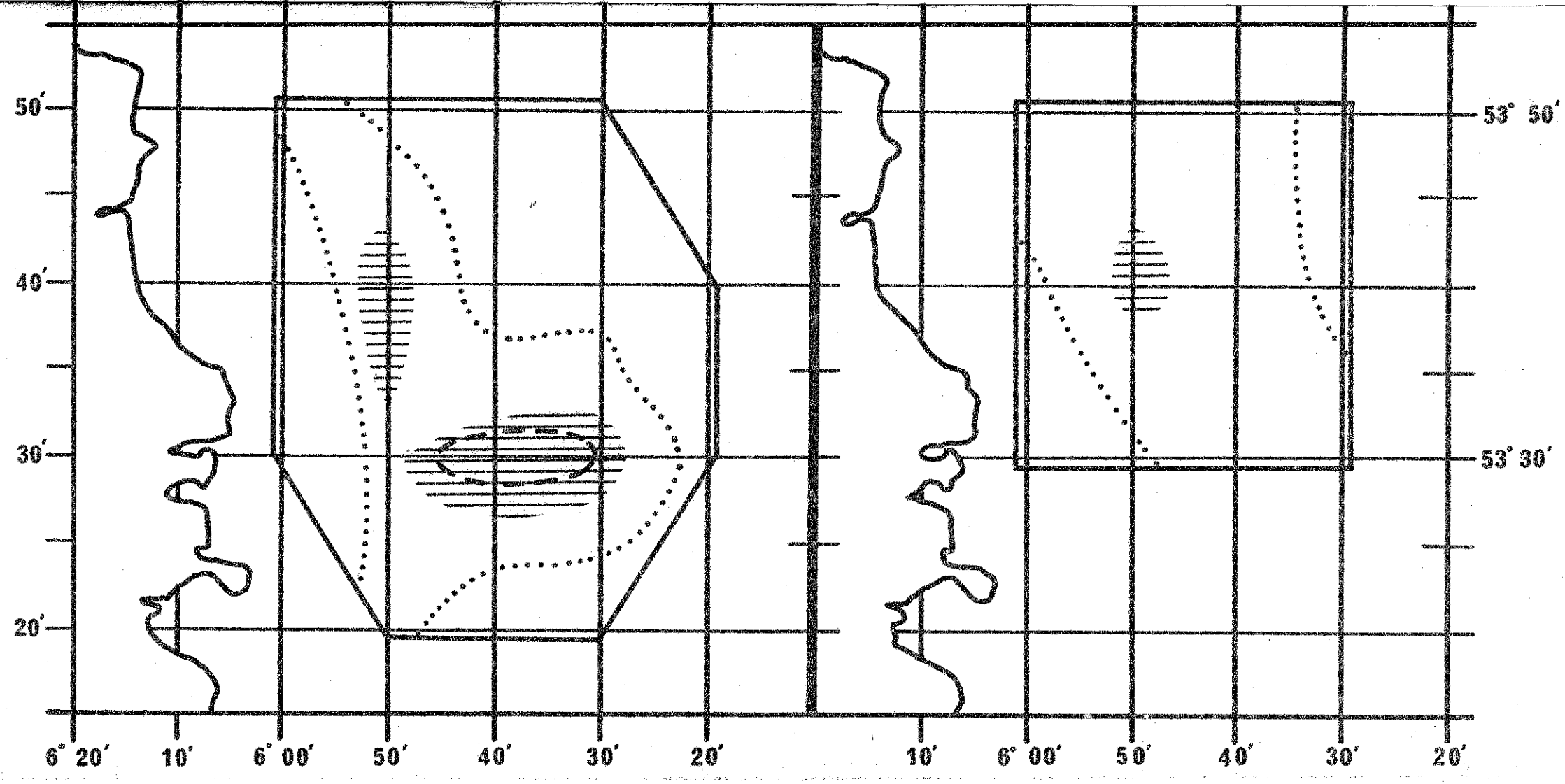


Fig. 3. Changes in catch per 30 minute haul at sunrise and sunset. Depths of hauls in fathoms.
N = Numbers in catch.



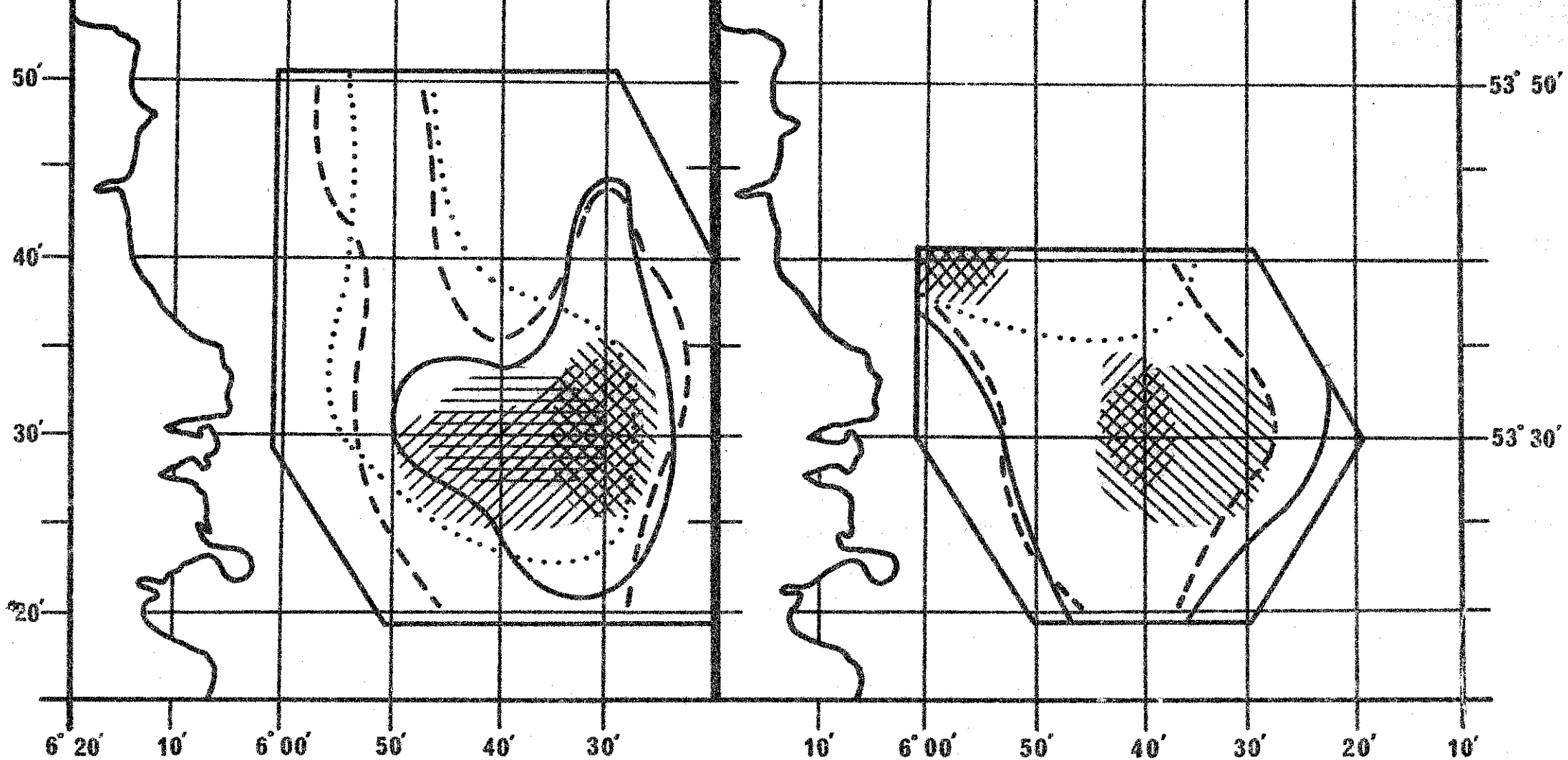
6 – 12 May 1970.

18 – 20 May 1970.

Fig.4. Numbers of prawn larvae in townet catch per 15 minute haul.

Legend; Stage 1 2 3 Stage 1 2 3

Over 10 Over 50



4–11 June 1970.

23–26 June 1970.

Fig.5. Number of prawn larvae in townet catch per 15 minute haul.

Legend; Stage 1 2 3 Stage 1 2 3

Over 10 Over 50

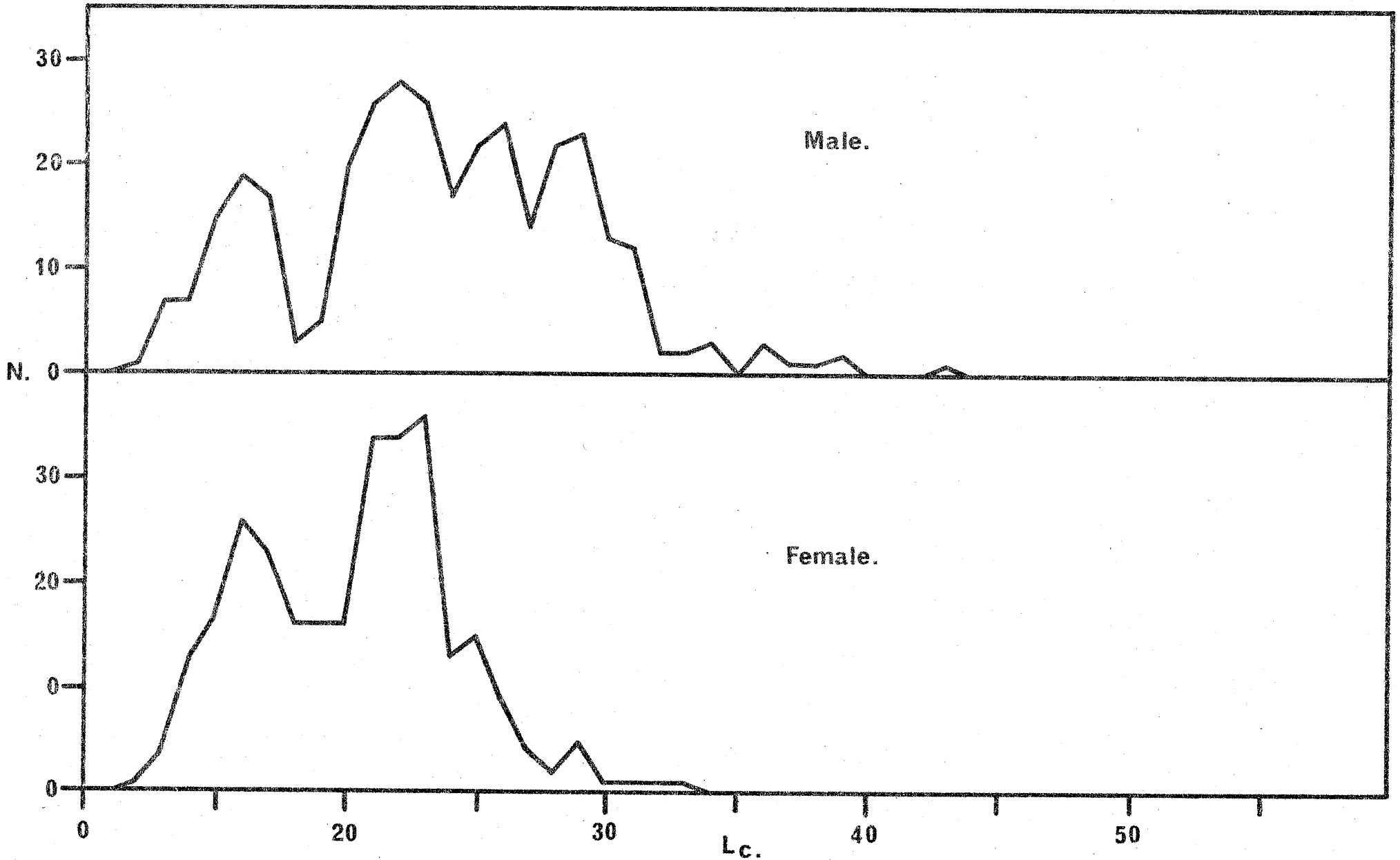


Fig. 6. Length frequency distribution of male and female prawns, sample of September 1969.
N = numbers, L_c = carapace length (mm).